REMARKS

I. Introduction

For the reasons set forth below, Applicants respectfully submit that all pending claims are patentable over the cited prior art references.

II. The Rejection Of Claims 1-6 And 22-23 Under 35 U.S.C. § 103

Claims 1-6 and 22-23 are rejected under 35 U.S.C. §103(a) as being unpatentable over Fujimori et al. (6,674,109) in view of Halliyal (6,674,138). Applicants respectfully traverse this rejection for at least the following reasons.

Claim 1 recites in-part a semiconductor device comprising...an intermediate insulator film wherein an intermediate insulator film is formed directly between at least one of the pairs consisting of the floating gate electrode and the ferroelectric film, and the ferroelectric film and the control gate electrode; and the intermediate insulator film is made of a hafnium oxide that contains nitrogen atoms. In the pending rejection, the Examiner admits that the intermediate insulator film of Fujimori does not comprise hafnium oxide that contains nitrogen atoms, but alleges that the intermediate insulator film 28 of Halliyal contains hafnium oxide with nitrogen atoms, as cited in col. 6, lines 20-24.

Additionally, claim 1 recites an intermediate insulator film that is ***directly*** formed between at least one of the pairs consisting of the floating gate electrode and the ferroelectric film, and the ferroelectric film and the control gate electrode.

In accordance with one exemplary embodiment of the present invention, an intermediate insulator film is placed between the floating gate electrode and the ferroelectric film, or between the ferroelectric film and the control gate electrode of the semiconductor device. As a result, the

leakage current flowing from the control gate electrode can be reliably prevented, thus extending the retention time of the semiconductor device (see, e.g., page 18, lines 8-24 of the specification). Halliyal does not cure this defect of Fujimori, because the first oxide layer 28 of Halliyal is not equivalent to the claimed intermediate insulator film. Even assuming *arguendo* that the high-k dielectric layer 30 of Halliyal can arguably be interpreted as the claimed intermediate insulator film, it is noted that the high-k dielectric layer 30 of Halliyal is ***not*** in contact with the floating gate electrode 44 or the control gate electrode 46.

Thus, as each and every limitation must be either disclosed or suggested by the cited prior art in order to establish a *prima facie* case of obviousness (see, **M.P.E.P. § 2143.03**), and Fujimori and Halliyal, alone or in combination, fail to do so, it is respectfully submitted that claim 1 is patentable over the cited prior art.

Moreover, Halliyal discloses a SONOS non-volatile memory operated by storing or emitting electrical charge in or from a gate insulator film comprising three layers, in a silicon oxide/silicon nitride/silicon oxide composition, (ONO) (Col. 1, lines 32-34). The ONO structure operates by storing electrical charge in the trap levels between the valence band and the conduction band of the silicon nitride layer (the forbidden band). These same levels do not exist in the silicon oxide band. When the silicon nitride layer is replaced with hafnium oxide, it can function as a SONOS non-volatile memory because the hafnium oxide layer has trap levels. However, hafnium oxide containing nitrogen atoms does not have trap levels in the forbidden band and therefore do not have a layer that can store or emit electrical charge due to the voltage applied to the gate electrode. Thus, hafnium oxide containing nitrogen does not function as a non-volatile memory. Therefore, it would not have been obvious to combine the teachings of Halliyal with the disclosure of Fujimori to obtain a semiconductor device comprising an

intermediate insulator film wherein the intermediate insulator film comprises a hafnium oxide that contains nitrogen atoms because the use of said nitrogen atoms would have rendered the invention of Halliyal inoperable.

The Examiner is directed to **M.P.E.P § 2143.01** under the heading "THE PROPOSED MODIFICATION CANNOT RENDER THE PRIOR ART UNSATISFACTORY FOR ITS INTENDED PURPOSE" which sets forth the applicable standard:

> If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

Accordingly, because the proposed modification renders the prior art unsatisfactory for its intended purpose, it is respectfully submitted that there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). Therefore, the proposed combination fails to establish *prima facie* obviousness of the pending claims.

III. All Dependent Claims Are Allowable Because The Independent Claims From Which They Depend Are Allowable

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co., 819 F.2d at 1100, 1108 (Fed. Cir. 1987).* Accordingly, as independent claim 1 is patentable for the reasons set forth above, it is respectfully submitted that all claims dependent thereon are also in condition for allowance.

IV. Conclusion

Accordingly, it is urged that the application is in condition for allowance, an indication of which is respectfully solicited.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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Date: October 27, 2005